PROC. BIOL. SOC. WASH.
100(3), 1987, pp. 433–446

FALLICAMBARUS (CREASERINUS) BURRISI AND *F. (C.) GORDONI,* TWO NEW BURROWING CRAWFISHES ASSOCIATED WITH PITCHER PLANT BOGS IN MISSISSIPPI AND ALABAMA (DECAPODA: CAMBARIDAE)

J. P. Fitzpatrick, Jr.

Abstract.—Two new burrowing crawfishes, closely related to *Fallicambarus (Creaserinus) byersi* (Hobbs) are described from southern Mississippi and Alabama. They share with *F. byersi* and *F. caesius* Hobbs the characteristic, not otherwise known in the genus, of having a row of long stiff setae along the ventrolateral margin of the chela. They differ from them in having a more slender central projection on the gonopod of the first form male and from each other by the degree to which the apex of the mesial process of that member is curved caudoproximally. Each species has a unique annulus ventralis, and other morphological features serve to indicate the several species.

Several years ago, when the Mississippi Academy of Science was initiating studies to identify the state's Rare and Endangered species, I called attention to the unique relationship between *Fallicambarus (Creaserinus) byersi* (Hobbs 1941) and pitcher plant (*Sarracenia* spp.) bogs. My discovery of a second, closely related, similarly environmentally restricted species elicited the interest of the Mississippi Natural Heritage Program. As a result, they have paid special attention to the collection of burrowers, and the results of some of their labors are reported here.

Fallicambarus (Creaserinus) burrisi, new species
Figs. 1, 2a–d

Diagnosis.—Antennal scale much reduced, lacking usual spiniform distal terminus of lateral thickened part (Fig. 1e); coxa of fourth pereiopod with large, caudomesially directed boss; telson undivided, entire. Ventrolateral surface of propodus of chela with row of long stiff setae near lateral margin. First pleopod of first form male inclined caudally in distal third, apices of terminal elements inclined at about 130° to main axis of pleopod shaft. Annulus ventralis of female large, about 1.3 times longer than wide; with lateral and caudal margins conspicuously raised; prominent inverted U-shaped sinus arising on caudal margin, well lateral to midline, passing cephalically 20% of length of annulus, and recurving and disappearing beneath cephalic overhang of caudal elevation on same side of midline as origin; overhang of caudal part of annulus completely obscuring postannular sclerite.

Holotype male, Form I.—Cephalothorax subovate, compressed (Fig. 1b, h); eyes reduced. Abdomen much narrower than thorax (6.2 and 9.6 mm); greatest width of carapace less than depth at caudodorsal margin of cervical groove (9.6 and 10.8 mm). Areola obliterated along most of length; length 39.6% of entire length of carapace (42.8% of postorbital carapace length). Rostrum depressed, with mildly convergent, slightly thickened margins constricting near midlength to tip of indistinctly delimited acumen, tip slightly upturned, reaching base of ultimate podomere of antennular peduncle;

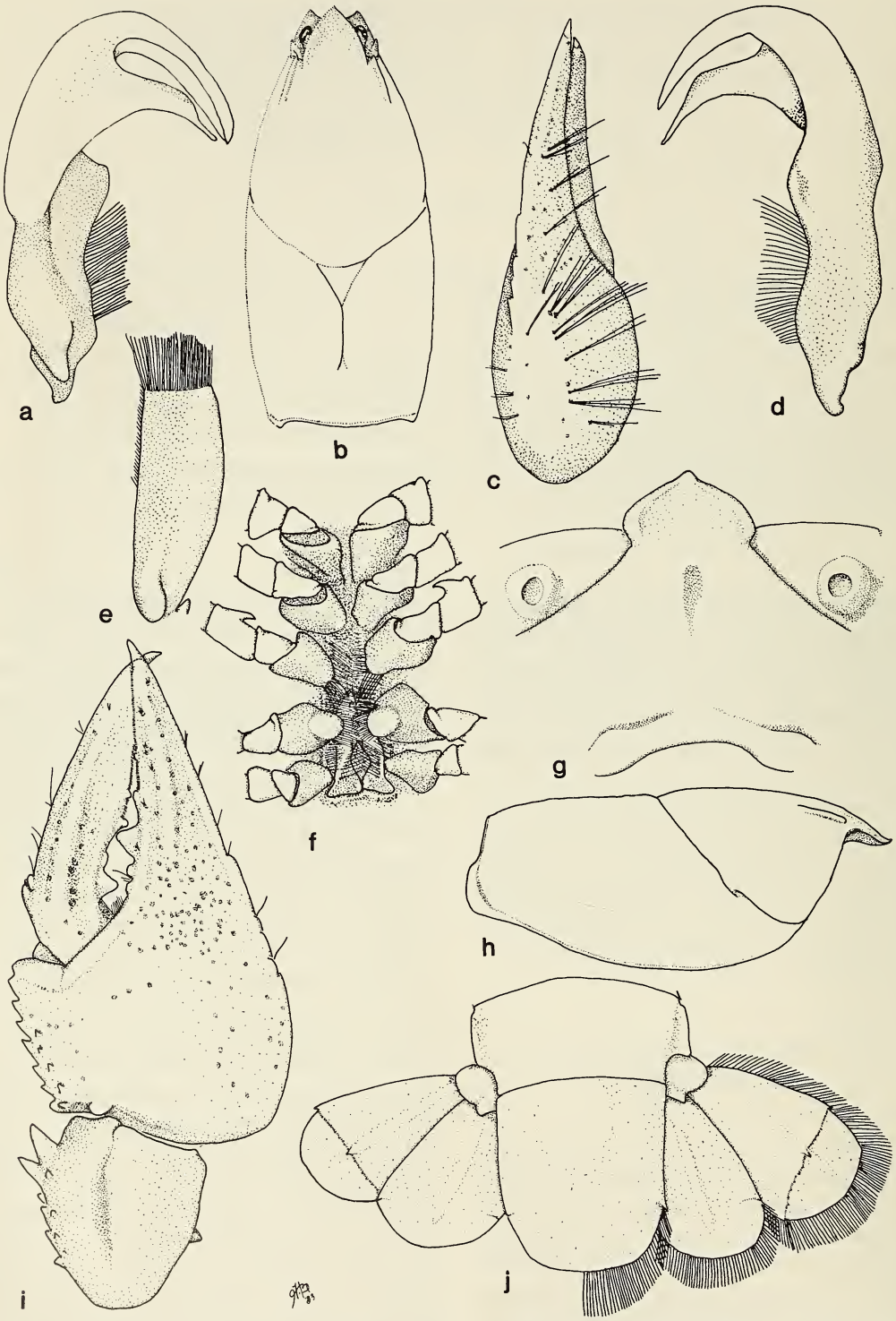

Fig. 1. *Fallicambarus* (*Creaserinus*) *burrisi,* holotype: a, Mesial view of first pleopod; b, Dorsal view of carapace; c, Lateral view of chela; d, Lateral view of first pleopod; e, Antennal scale; f, Ventral view of thoracic

dorsal surface deeply concave cephalically and subplanar caudally. Subrostral ridges poorly evident in dorsal aspect. Postorbital ridges prominent, grooved laterally, and terminating cephalically in weak tubercles. Suborbital angle and branchiostegal spine absent. Carapace sparsely punctate dorsally with slightly granulate branchiostegites.

Abdomen shorter than carapace (17.3 and 21.7 mm); pleura quite short and broadly rounded; cephalic lobe of pleuron of second segment overlapping reduced pleuron of first (Fig. 2e). Telson not clearly divided into cephalic and caudal portions (Fig. 1j); dextral margin provided with short, acute, fixed spine posterior to midlength, spine absent from corresponding position on sinistral margin. Proximal podomere of uropod with broadly rounded tubercle on medial lobe; both rami rounded distally; lateral ramus with very tiny fixed lateral spine and small, acute, premarginal medial spine at end of weak median ridge; mesial ramus with small, fixed lateral spine and median ridge.

Cephalomedian lobe of epistome (Fig. 1g) subovoid with slightly raised margins and prominent cephalomedian tubercle; main body with longitudinal median fovea and transverse grooves along cephalolateral margins of arched epistomal zygoma. Ventral surface of proximal podomere of antennule with obtuse tubercle near midlength. Antennal peduncle lacking spines; flagellum reaching not quite to caudal margin of carapace. Antennal scale (Fig. 1e) short, stout, lacking usual broad lamellar part mesially and terminal distolateral spine scarcely developed and obscured by dense setal row; about 2.5 times longer than wide; distal margin provided with dense row of long, stiff setae; scale reaching about midlength of penultimate podomere of antennular peduncle. Ventral surface of ischium of third maxilliped (Fig. 2b) with sparse band of long, stiff setae just mesial to midline and irregular submedian row of much shorter stiff setae, often clustered.

Chela (Fig. 1i) about 1.7 times longer than broad, strongly depressed; mesial margin of palm with row of 7 tubercles, second row of 5 just medial to it; dorsal surface with scattered, sometimes setiferous punctations, but numerous only on fingers; ventral surface with arched sublateral row of punctations bearing tufts of long setae (Fig. 1c); distal ridge, opposite base of dactyl, with subacute tubercle and low rounded one medial to it; middle third of lateral (outer) margin of chela with row of 4 low tubercles. Opposable margin of fixed finger with row of 5 tubercles in proximal two-thirds, middle one markedly largest; single row of minute denticles in distal half; small tuft of setae obscuring margin in most proximal part; dorsal and ventral surfaces with prominent submedian longitudinal ridge flanked by punctations; lateral margin strongly costate. Opposable margin of dactyl with row of 4 tubercles in proximal half, proximalmost largest; conspicuous excision in margin delimited distally by penultimate, next largest, tubercle; single row of crowded minute denticles beginning at penultimate tubercle and extending distally to horny tip. Mesial margin with cluster of 3 tubercles, one set ventrally to others, in proximal fourth and row of punctations with long stiff setae extending distally; dorsal and ventral surfaces with prominent submedian longitudinal ridge flanked by punctations.

Carpus (rotated about 20° counterclockwise in Fig. 1i) with prominent longitudinal furrow dorsally, flanked mesially by irregular row of 4 tubercles; mesial surface with twin spikelike spines in distal fourth and 3 much smaller spines proximal to them; ventral surface smooth with 2 small subacute tubercles in mesio- and laterodistal corners;

←

region; g, Epistome; h, Lateral view of carapace; i, Dorsal view of distal podomeres of cheliped; j, Dorsal view of telson and uropods.

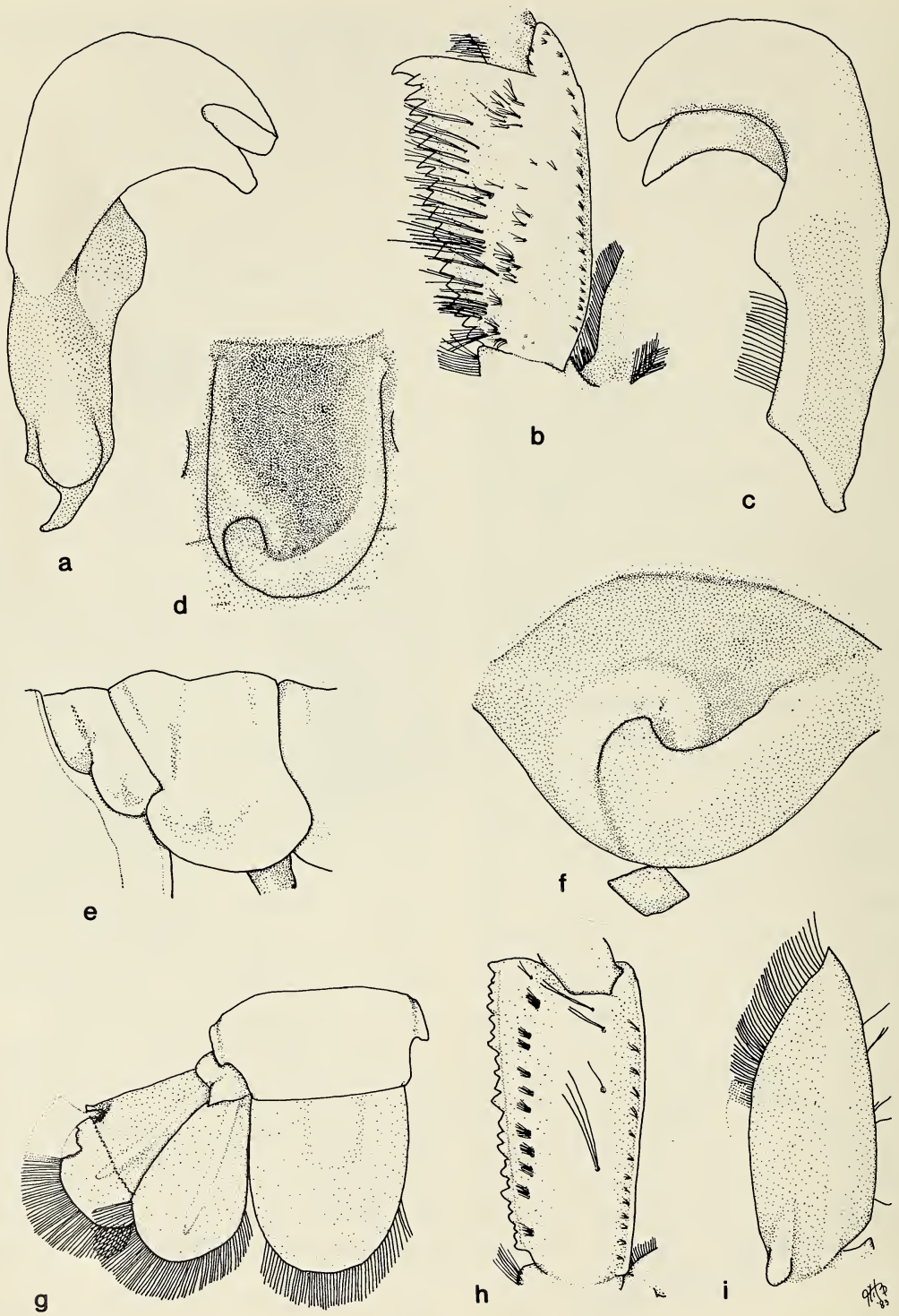

Fig. 2. Types of new species of *Fallicambarus* (a–d, *F. burrisi*; e–i, *F. gordoni*): a, Mesial view of first pleopod of morphotype; b, Ventral view of ischium of third maxilliped of holotype; c, Lateral view of first pleopod of

lateral surface punctate with prominent ventrolateral articulate knob. Dorsodistal surface of merus entire with small punctations; ventromesial margin with row of 7 small tubercles, distalmost and antepenultimate ones subacute; ventrolateral margin with row of 6 subacute tubercles intermixed with row of long stiff setae. Sufflamen well developed.

Chela of second pereiopod with row of long setae on both margins of palm and on dorsal and ventral margins of carpus; distal half of ventral margin of merus with similar row of setae.

Ischium of third pereiopod with simple curved hook not reaching basioischial articulation (Fig. 1f) and not opposed by tubercle on basis. Coxa of fourth pereiopod with large, caudomesially directed boss. Coxa of fifth pereiopod lacking caudomesial boss but with setiferous ventral membrane.

First pleopod (Fig. 1a, d, f) not quite reaching coxa of third pereiopod, situated deep within sternum and obscured, particularly distally, by setae extending caudally and mesially from ventral margins of sternum and proximal margins of coxae of third and fourth pereiopods; proximomesial spur lacking; distal half of shaft inclined caudally; terminal elements consisting of broad, corneous central projection, scarcely notched subterminally; and mesial process attenuate distally but apical third somewhat flattened in cephalocaudal aspect, entire process deflected sharply laterad, and tip not extending beyond tip of central projection; cephalic process absent.

Allotypic female.—Excluding secondary sexual characters, differing from holotype in following respects: small spine on sinistral margin of telson and none on dextral; mesial margin of palm with only one tubercle dorsomedial to mesialmost row; mesial margin of dactyl with row of 3 tubercles in proximal third; distal ridges of ventral surface of palm with only one tubercle opposite base of dactyl. Carpus of cheliped with single spikelike tubercle on distomesial surface; tubercles associated with ventrodistal margin more acute. Tubercles associated with ventromesial margin of merus of cheliped all acute.

Annulus ventralis (Fig. 2d) deeply excavate except for lateral and caudal elevated ridges; as described in Diagnosis. Caudal overhang of annulus completely obscuring first abdominal sclerite. First pleopods much reduced and biramous.

Morphotypic male, Form II.—Differing from holotype in following respects: mesial margin of palm with row of 8 tubercles, second more medial row of 3 near midlength, and single tubercle just medial to central tubercle of latter row; dactyl with row of 5 tubercles on mesial margin and with tubercle just dorsal to second from base; distal ridge of ventral surface of palm with 2 acute tubercles opposite base of dactyl. Carpus with single spikelike tubercle on mesial margin. Ventromesial margin of merus of cheliped with row of 9 subacute tubercles, ventrolateral margin with row of 8. Hook on ischium of third pereiopod as well developed as in holotype, but caudomesial boss of coxa of fourth pereiopod less well developed. First pleopod (Fig. 2a, c) with distal half not so clearly inclined caudally; both terminal elements non-corneous, blunter; central projection lacking subapical notch; mesial process contiguous to central projection along basal half, tip extending no further caudad than central projection.

Type locality.—Burrows in saturated sandy soil of hillside *Sarracenia* bog; T4N, R5W, E/2 Sec. 21, Greene County, Mississippi.

Disposition of types.—The holotypic male,

←

morphotype; d, Annulus ventralis of allotype; e, Lateral view of cephalic segments of abdomen of holotype; f, Annulus ventralis of allotype; g, Dorsal view of telson and left uropod of holotype; h, Ventral view of ischium of third maxilliped of holotype; i, Antennal scale of holotype.

Form I, the allotypic female, and the morphotypic male, Form II (USNM 206881, 206883, and 206882, respectively), are located in the National Museum of Natural History, Smithsonian Institution, as well as a small paratypic series (3 ♂I, 1 ♂II, 4 ♀, 2 ♂ imm., 1 ♀ imm.). Another series of paratypes (2 ♂I, 9 ♀, 2 ♂ imm., 3 ♀ imm.) is at the Mississippi Museum of Natural Science, plus one dubiously identified collection, probably assignable to this species and not designated paratypic (1 ♂II, 1 ♂ imm.).

Variations and color.—Most of the variations encountered are represented among the primary types, but some points need to be noted. In a male, Form II, from Washington County, Alabama, the setae are absent from the ventrolateral margin of the palm, and in the same specimen, the ischium of the third maxilliped is not as hirsute as usual. Strikingly, in second form males, the caudomesial boss of the coxa of the fourth pereiopod is nearly as well developed as in the first form male. Equally striking is the remarkable congruence of tubercular ornamentation of the opposable margins of the fingers; not only are the numbers constant, but the relative sizes seem to be independent of sex and are the same. I have no specific color notes on this species, but my field notes in one instance (Washington Co., Alabama) indicate that the colors do not differ significantly from those of *Fallicambarus* (*Creaserinus*) *byersi.*

Size.—The largest specimen collected is the morphotype; the smallest first form male is the holotype, and the largest has a 26.4 mm carapace length; the largest female, 27.4 mm. For measurements see Table 1.

Range and specimens examined.—All specimens were collected from pitcher plant bogs in the Chickasawhay and Escatawpa drainages of Alabama and Mississippi.

ALABAMA. Washington County (all Escatawpa drainage): (1) bog, 1.5 mi (2.4 km) SE of County Road 18 (Vinegar Bend Rd.) on U.S. Hwy. 45, T3N, R3W, 1 ♂I, 3 ♀, 2 ♂ imm., 1 ♀ imm., 6 Apr 1974, J. F. Fitzpatrick, Jr., and B. A. Laning, colls.; (2) bog, 2.1 mi (3.4 km) NW of Mobile County line on U.S. Hwy. 45, T2N, R3W, 1 ♂II, 25 May 1974, J.F.F., Jr., and B.A.L., colls.; (3) small swamp stream 9.4 mi (15.1 km) N of Mobile County line on St. Rte. 17, T3N, R3W, 1 ♀, 3 ♀ imm., 22 Apr 1970, E. Black and H. H. Hobbs, Jr., colls.; (4) 6.2 mi (10.0 km) W of McIntosh on St. Rte. 35, hillside seepage, T4N, R2W, 1 ♂I, I ♀, 21 Apr 1970, E. B. and H.H.H., colls.; (5) roadside ditch, 5 mi (8.0 km) N of Citronelle on U.S. Hwy. 45, T2N, R3W, 1 ♂II, 1 ♀, 2 ♂ imm., 2 ♀ imm., 21 Apr 1970, E. B. and H.H.H., colls.

MISSISSIPPI. Greene County (all Chickasawhay drainage): (6) about 9.5 mi (15.3 km) S of town of State Line, 1 ♂I, 1 ♂II (morphotype), 1 ♀, 10 May 1979, John W. Burris, coll.; (7) about 1 mi W of Yellow Pine, Alabama, T5N, R5W, NE/4 Sec. 14, 1 ♂I, 2 Aug 1979, J.W.B., coll; (8) type locality, 1 ♂I, 1 ♀ (holo- and allotype), 25 Jun 1981, J.W.B., coll.; (9) Kurtz State Forest, seepage area in headwaters of Brannon Creek, T4N, R5W, SE/4 Sec. 21, 3 ♀, 1 ♀ imm., 29 Mar 1983, S. E. Mott and M. Stegall, colls.; Jackson County (all Escatawpa drainage): (10) 0.75 roadmi (1.2 km) W of Escatawpa River on St. Rte. 614, T5S, R5W, SE/4 SW/4 SE/4 Sec. 2, 2 ♀, 2 ♂ imm., 2 ♀ imm., 1 unsexed carapace fragment, 19 Apr 1983, R. L. Jones and S.E.M., colls.; (11) 4.8 airmi (7.7 km) SW of George County line at Alabama state line, T4S, R5W, NE/4 NE/4 SE/4 Sec. 16, 3 ♀, 15 Aug 1984, R.L.J., coll.; (12) (probably assignable to this species) T4S, R5W, SE/4 SW/4 NW/4 Sec. 16, 1 ♂II, 1 ♂ imm., 12 Dec 1984, R.L.J., J. Wiseman, and R. Lohoefnar, colls.

Environmental notes.—The species seems always to be associated with pitcher plant bogs, always burrowing, and usually into a sandy clay substrate, exhibiting complex branching patterns in the burrow design; often a trickle of water runs through the habitat—except perhaps in midsummer. My best notes are from locality no. 2, above. There *Sarracenia leucophylla* was the dom-

inant plant, by far, but *S. alata, S. psittacina, Dichomena latifolia, Drosera rotundiflora* and *Stockesia laevis* were also conspicuous. At that time, *Cambarus* (*Lacunicambarus*) *diogenes ludovicianus* Faxon, 1884, was also dug from burrows in the area. The site had been visited earlier (on 6 Apr) when the dominant identifiable plants were *S. alata* and *D. rotundiflora,* the former in bloom. Also identifiable were *S. psittacina* and *S. leucophylla.* In flower were *D. latifolia, S. laevis, Drosera filiformes* and *Lachnocaulon anseps. Fallicambarus* burrows were provided with freshly worked and thoroughly plugged chimneys 6–8 in (15.2–20.3 cm) tall. A solid plug filled the burrow to a depth of 8–10 in (20.3–25.4 cm), and beneath this, the burrow was filled with a slurry of about 50% water and 50% sand and clay. Only rarely was a clear chamber encountered, and no crawfishes were collected although several burrows were excavated as far as could be detected. About 12 in (30.5 cm) below the surface, burrow temperature fell sharply to about 65°F from about 85°F air temperature.

Relationships.—*Fallicambarus* (*Creaserinus*) *burrisi* has its closest affinities with *F.* (*C.*) *byersi, F.* (*C.*) *gordoni,* n. sp., below, and *F.* (*C.*) *caesius* Hobbs, 1975, and more remotely to *F.* (*C.*) *danielae* Hobbs, 1975, and *F.* (*C.*) *oryktes* (Penn and Marlow 1959). Among the common features shared by the first four species are a caudally inclined gonopod of the first form male, a conspicuous row of long setae on the ventrolateral surface of the palm of the chela, and the abdomen of the male being markedly narrower than the carapace. The annulus of the *F.* (*C.*) *burrisi* female, however, is unique; in no other species of the genus is it so scooplike and does it project so far caudad. The conspicuous boss on the coxa of the male fourth pereiopod is not matched by any close relative. The attenuate tip of the mesial process of the first form male extends no further than the apex of the central projection, a characteristic shared with *F.* (*C.*) *byersi* and *F.* (*C.*) *oryktes.* It can be separated from *F.* (*C.*) *oryktes* by the row of setae on the ventrolateral margin of the palm and from *F.* (*C.*) *byersi* by the lack of an inflated part of the mesial process which overlaps the caudal margin of the central projection. The relatively slender terminal elements of the first pleopod and overall configuration of the palm of the cheliped are more like *F.* (*C.*) *oryktes* than the other mentioned species, but *burrisi* shares more features with *F.* (*C.*) *byersi, F.* (*C.*) *caesius,* and *F.* (*C.*) *danielae* than with *oryktes.*

Fallicambarus (*Creaserinus*) *gordoni,* new species
Figs. 2e–i, 3

Diagnosis.—Antennal scale reduced, usual lamellar development of mesial part reduced. Ventrolateral surface of propodus of chela with row of long stiff setae near lateral margin; coxa of fourth pereiopod of first form male with small, but conspicuous, transversely-oriented caudomesial boss. First pleopods of first form male inclined caudally in distal one-fourth; apex of central projection directed at angle of about 120° to main axis of pleopod, but mesial process at nearly right angle. Annulus ventralis of female about as long as wide, deeply excavate cephalically and sigmoid sinus so developed that opposing halves of raised caudal part resembling interlocking fingers; annulus projected caudad only slightly, overhang scarcely, if at all, obscuring postannular sclerite.

Holotypic male, Form I.—Cephalothorax subovate, compressed (Fig. 3b, f); eyes reduced. Abdomen much narrower than thorax (6.0 and 9.1 mm); greatest width of carapace less than depth at caudodorsal margin of cervical groove (9.1 and 10.5). Areola obliterated along middle half of length; length 37.9% of entire length of carapace (43.0% of postorbital carapace length). Rostrum only slightly depressed, with moderately converging, slightly thickened mar-

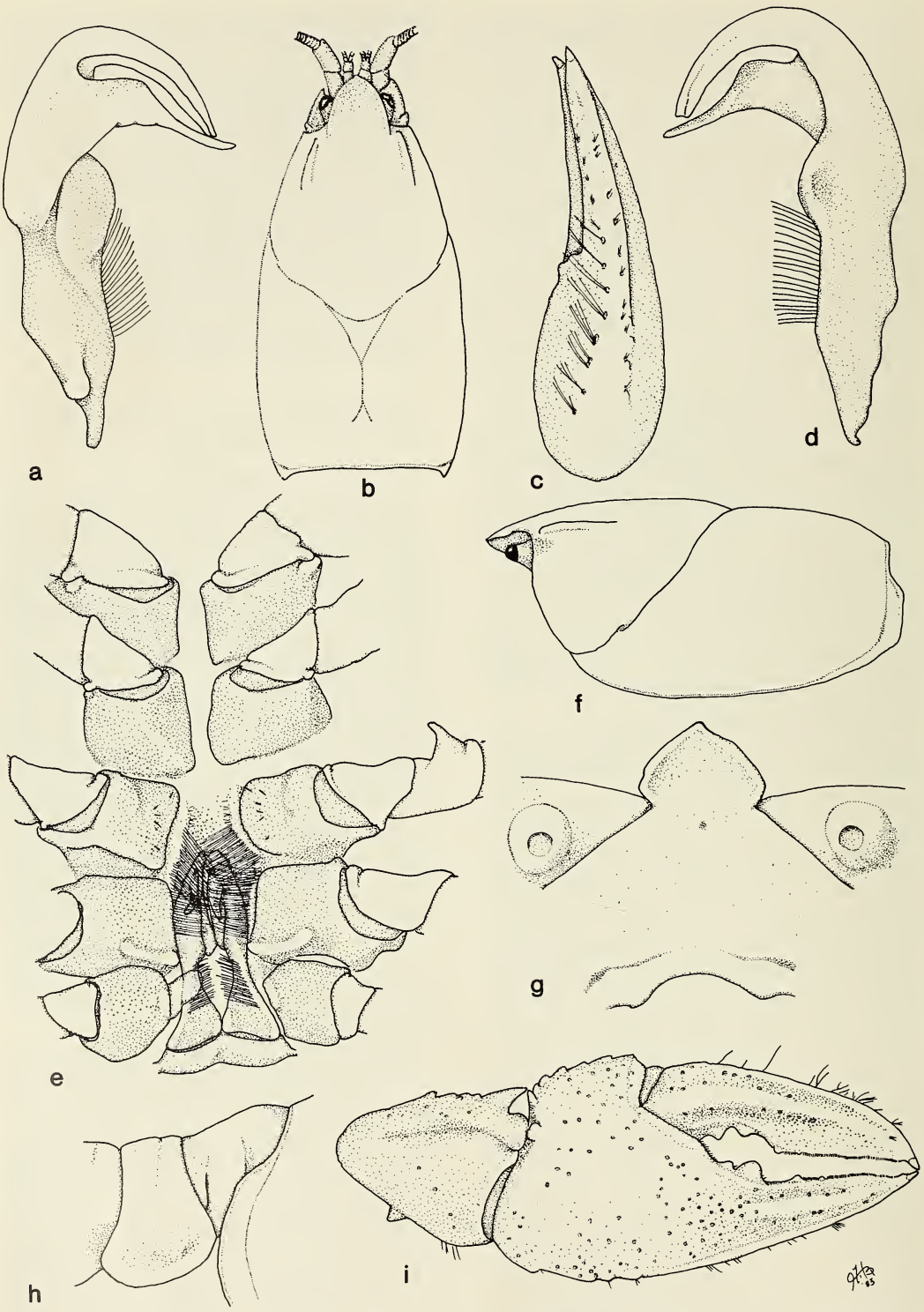

Fig. 3. *Fallicambarus* (*Creaserinus*) *gordoni,* holotype: a, Mesial view of first pleopod; b, Dorsal view of carapace; c, Lateral view of chela; d, Lateral view of first pleopod; e, Ventral view of thoracic region; f, Lateral

gins, latter constricting from near midlength to obtuse acumen; tip not upturned and reaching not quite to base of ultimate podomere of antennular peduncle; dorsal surface concave cephalically becoming subplanar caudally. Subrostral ridges poorly evident in dorsal aspect. Postorbital ridges prominent, grooved laterally and terminating cephalically in weak tubercles. Suborbital angle virtually obsolete; branchiostegal spine absent. Carapace sparsely punctate dorsally with slightly granulate branchiostegites.

Abdomen shorter than carapace (16.5 and 21.1 mm); pleura quite short and very broadly rounded; cephalic lobe of pleuron of second segment not prominent but overlapping reduced pleuron of first (Fig. 3h). Telson undivided (Fig. 2g), lacking lateral spines. Proximal podomere of uropod with subacute tubercle on mesial lobe; both rami rounded distally; cephalic portion of lateral ramus with small fixed spine in distolateral corner and row of small acute spines along entire distal margin, median one only very slightly larger than rest; mesial ramus with weakly developed median ridge, but lacking spines.

Cephalomedian lobe of epistome (Fig. 3g) broadly subtriangular with slightly raised margins and weak cephalomedian tubercle; main body with small median fovea near cephalic end and transverse grooves along cephalolateral margins of arched epistomal zygoma. Ventral surface of proximal podomere of antennule with small tubercle near midlength. Antennal peduncle lacking spines; flagellum reaching about midlength of areola. Antennal scale (Fig. 2i) short, stout, usual broad lamellar mesial part much reduced; terminal distal spine of expanded lateral portion small but stout and subacute; about 2.1 times longer than wide; mesial and mesiodistal margins with dense row of long, stiff setae, such setae sparse on lateral margin; scale reaching about midlength of penultimate podomere of antennal peduncle. Ventral surface of ischium of third maxilliped (Fig. 2h) with row of long, stiff setae just mesial to midline and widely scattered, sometimes clustered submedian row.

Chela (Fig. 3i) about 1.8 times longer than broad; strongly depressed; mesial margin of palm with single row of 6 tubercles; dorsal surface with scattered setiferous punctations, most numerous near base of immovable finger; ventrolateral surface with arched row of punctations, each with one or more long, stiff setae (Fig. 3c); distal ridge, opposite base of dactyl, with low tubercle; proximal third of lateral (outer) margin of palm with row of 4 low tubercles. Opposable margin of fixed finger with row of 4 tubercles in proximal half, second from base markedly largest, distal subequal in size and smaller; single row of minute denticles on distal half, beginning just distal to penultimate tubercle; tuft of setae in most proximal part almost negligible; dorsal and ventral surfaces with prominent longitudinal ridges flanked by punctations; lateral margin strongly costate. Opposable margin of dactyl with 4 tubercles in proximal half, 2 in conspicuous excision largest, and penultimate one delimiting distal extent of excision; single row of minute denticles beginning just distal to ultimate tubercle and extending nearly to corneous tip; mesial margin with complex ridge pattern in basal third but lacking tubercles; long setae prominent only in distal half; dorsal and ventral surfaces with prominent longitudinal ridge flanked by punctations.

Carpus with prominent longitudinal furrow dorsally, flanked mesially by few punctations; mesial surface with spikelike tubercle in distal fourth and irregular row of 4 subacute tubercles proximal to it; ventral surface smooth with low subacute tubercle in each distal corner; lateral surfaces sparse-

---

←

view of carapace; g, Epistome; h, Lateral view of cephalic segments of abdomen; i, Dorsal view of distal podomeres of cheliped.

ly punctate with few long setae and prominent ventrolateral articular knob. Dorsodistal surface of merus entire with few small punctations; ventromesial margins with row of 10 rounded to slightly subacute tubercles; ventrolateral margin with row of 7, antepenultimate and penultimate bifid, low tubercles flanked medially by row of long stiff setae. Sufflamen well developed.

Chela of second pereiopod with row of long setae on both margins of palm, and on dorsal and ventral margins of carpus; distal half of ventral surface of merus with similar row.

Ischium of third pereiopod with simple, slightly curved hook not overreaching basioischial margin (Fig. 3e) and not opposed by tubercle on basis. Coxa of fourth pereiopod with small but prominent, transversely oriented caudomesial boss. Coxa of fifth pereiopod lacking boss but with setiferous ventral membrane.

First pelopod reaching just beyond caudal margin of coxa of third pereiopod, situated deeply within sternum, and somewhat obscured, particularly distally, by setae extending caudally and mesially mostly from ventrolateral margins of sternum; proximomesial spur lacking; distal fourth of shaft inclined caudally (Fig. 3a, d, e); terminal elements consisting of moderately broad, corneous central projection, obtusely notched subapically; mesial process subspatulate in distal half, expanded and somewhat compressed laterally just proximal to midlength but not contiguous with adjacent central projection; cephalic process absent.

Allotypic female.—Excluding secondary sexual characters differing from holotype in following respects: merus of cheliped with 8 (none bifid) spinose tubercles on ventrolateral margin; ventromesial row of 9; inner margin of palm with small squamous tubercle just dorsolateral to third from proximal end of row.

Annulus ventralis (Fig. 2f) about as broad as long, deeply excavate cephalically; caudal margin elevated, sinistral half tilted cephalically overhanging more cephalic part of caudal half of annulus; sinus originating beneath overhang near midline and extending cephalically short distance before recurving caudally, forming inverted-U, and disappearing before reaching caudal margin; dextral elevated portion flanking cephalic and lateral sides of sinus disappearing beneath sinistral overhang, sculpture providing overall appearance of interlocking fingers when viewed ventrally. Postanular sclerite reduced and subconical; provided with setae. First pleopod reduced and biramous.

Male, Form II.—No morphotype is designated because in all of the second form males I have seen there is so much variability, especially in the first pleopod, that I cannot select one as "typical" of the species. There is no consistency in the relative lengths of the terminal elements; they are subequal in 26.7%, the mesial process longer in 60.0%, and the central projection longer in 13.3%. The elements are bent (in relation to the principal axis of the basal part of the pleopod) about 90° in 33.3%, about 135° in 20.0%, between 90 and 135° in 33.3%, and up to 180° in 13.4%. The two elements are contiguous through at least 90% of their lengths in 37.5%, but are not so in 62.5%. The central projection is always blunt or bluntly rounded apically, but the mesial process, although always tapering from base to tip, can be described as apically constricted only in 20% of the specimens. None of these characteristics seems to be correlated with each other; neither does size seem to be a factor in the nature of their expression. Two other characters seem to be more developed as the animal gets larger: the hook on the ischium of the third pereiopod and the caudomesial boss of the coxa of the fourth. Nevertheless, even this relationship is not absolute. In five specimens the hook was as prominent as in the holotype (and other first form males). Their carapace lengths ranged from 24.1 to 30.4 mm, but the hook was much less developed in three

other animals of the same size range (24.8, 24.8 and 25.3). Generally, the boss size was correlated with hook size; in one second form male, however (carapace length 28.0), it was scarcely identifiable. In one animal, the boss was rounded, although not as much so as in *F.* (*C.*) *burrisi,* and the associated females were clearly assignable to *F.* (*C.*) *gordoni.* Other types of variation are discussed below.

Type locality.—DeSoto National Forest, Camp Shelby Military Reservation, T2N, R10W, SE/4 NE/4 SE/4 Sec. 5, Perry County, Mississippi. Here the animals were dug from multiple-branched burrows in saturated sandy soil at the edge of a pitcher plant savannah. Nearby (within 1 km) burrows yielded specimens of *Cambarus* (*Lacunicambarus*) *diogenes ludovicianus* and *Procambarus* (*Ortmannicus*) *planirostris* Penn, 1953.

Disposition of types.—The holotype and allotype (USNM 206877 and 206878, respectively) are deposited in the National Museum of Natural History, Smithsonian Institution, together with a paratypic series (1 ♂II, 2 ♀, 1 ♀ imm., 1 ♀ ov.); The Mississippi Museum of Natural Science has a larger paratypic series (4 ♂I, 19 ♂II, 19 ♀, 3 ♂ imm., 4 ♀ imm.).

Variations.—Some of the variability encountered is encompassed within the descriptions of the types and discussion of the second form male, above, but other differences which were encountered merit discussion here. In all but two of the females (1 adult, 1 juvenile) the annulus was a mirror image of the allotype. In two mature females the sinus is more broad than that of the allotype, and, independent of maturity, in three the cephalic overhang of the caudal elevation is more pronounced. In about half the specimens, the tip of the rostrum is slightly upturned, but in a nearly equal number, the apical development is so unpronounced that one could not term the slight compression there an acumen. In nearly two-thirds of the specimens the cephalic extremity of the postorbital ridge merges imperceptibly into the cephalothorax, a situation somewhat more prevalent in larger than smaller specimens. The cephalolateral margins of the epistomal zygoma in many specimens have deeper pits associated with their cephalolateral bases than do the type specimens.

A remarkably early establishment of the pattern of tubercles associated with the opposable margins of the fingers of the chela apparently occurs. The smallest animals I have seen (15.4–19.0 mm cephalothorax length) all have a hand which in size and ornamentation allows them to be unquestionably assigned to this species. In some adults, however, there are differences in the arrangement and number of tubercles that are not clearly associated with regeneration of the member. Two females and a second form male from locality (8) below have the more basal tubercle in the excision of the movable finger larger than the next most distal, and the tubercle which marks the distalmost limit of the excision is, by far, the largest of the three; just distal to this last-mentioned tubercle are two small rounded ones. The proximolateral margin of the dactyl has a subtriangular cluster of three low tubercles. On the opposable margin of the immovable finger opposite the dactyl excision is a small, but still prominent, tubercle proximal to the usual two. Several animals from several localities also have some kind of tubercular development in the proximomesial region of the dactyl.

Setal development is likewise variable. In about half the specimens, the ischium of the third maxilliped has more than one, often arranged in a row, medial punctation in its basal half from which a tuft of long stiff setae emerges; in two animals from different localities, their maxillipeds were asymmetrical with respect to this character. Although always present, the row of setiferous punctations along the ventrolateral surface bears setae of different lengths and number; in only one specimen were the setae as long as

Table 1.—Measurements (in mm) of types of *Fallicambarus* (*Creaserinus*) *burrisi* n. sp. and *F.* (*C.*) *gordoni* n. sp.

	Holotype	Allotype	Morpho-type
F. (*C.*) *burrisi*			
Carapace			
Total length	21.7	23.0	29.6
Postorbital length	20.1	21.2	26.5
Width	9.6	10.6	13.7
Height	10.8	10.9	14.5
Areola			
Length	8.6	9.0	12.0
Rostrum			
Length	3.5	3.7	5.0
Width	4.0	3.8	5.0
Chela			
Length, mesial margin palm	4.1	3.7	5.2
Width, palm	6.9	6.1	9.5
Length, lateral margin propodus	11.9	11.8	16.9
Length, dactyl	7.0	7.4	10.5
Abdomen			
Length	17.3	17.7	23.3
Width	6.2	6.6	9.0
F. (*C.*) *gordoni*			
Carapace			
Total length	21.1	21.0	—
Postorbital length	18.6	18.6	—
Width	9.1	8.5	—
Height	10.5	9.4	—
Areola			
Length	8.0	8.1	—
Rostrum			
Length	3.6	4.3	—
Width	4.0	4.4	—
Chela			
Length, mesial margin palm	3.7	3.0	—
Width, palm	6.1	5.5	—
Length, lateral margin propodus	11.2	11.0	—
Length, dactyl	7.0	7.3	—
Abdomen			
Length	16.5	10.2	—
Width	6.0	5.6	—

found in *F.* (*C.*) *byersi* and *F.* (*C.*) *burrisi*. The setae along the lateral margin of the dactyl also vary in number and length, but in only one specimen was there no trace of such.

The apex of the central projection of the first form male is blunt, but only in the holotype and one other is there any suggestion of a notch, and such indication is most pronounced in the holotype. In the first form male from locality (4) below the hook on the ischium of the third pereiopod is so acutely arched that the tip clearly overreaches the basioischial margin.

Size.—The smallest first form male is 21.0 mm in cephalothorax length, and the largest, 25.5. The largest second form male is 30.4 mm. The largest female is 32.5 mm and is the largest animal collected; the ovigerous female is 28.1 mm in cephalothorax length. For measurements see Table 1.

Range and specimens examined.—This crawfish is known from eight locations, all in the DeSoto National Forest (Pascagoula River drainage) in Perry County, MISSISSIPPI: (1) type locality, 1 ♂I, 1 ♀ (holo- and allotype, respectively), 25 Oct 1982, Robert L. Jones, coll.; (2) Camp Shelby Military Reservation, T2N, R10W, NW/4 SW/4 SW/4 Sec. 4, 1 ♂II, 1 ♀, 1 ♀ imm., 5 Nov 1982, R.L.J., K. L. Gordon, S. Mott, colls.; (3) Camp Shelby Military Reservation, T2N, R10W, SE/4 SW/4 NW/4 Sec. 15, 1 ♀, 1 ♀ ov., 9 Nov 1982, R.L.J., S.M., and K.L.G., colls.; (4) T2N, R10W, NE/4 NW/4 NE/4 Sec. 8, 3.3 airmi (5.3 km) SSE of New Augusta, 1 ♂I, 3 ♀, 29 Mar 1985, R.L.J., coll.; (5) compartment 71, T2N, R10W, NW/4 NE/4 SW/4 Sec. 20, bog on S side of Forest Service Rd. 304, about 0.45 airmi (0.7 km) SSW of jct. F. S. Rd. 304 and St. Rte. 29, 3 ♂I, 7 ♂II, 3 ♀, 18 Mar 1986, R.L.J. and K.L.G., colls.; (6) compartment 62, T2N, R10W, SE/4 NE/4 NW/4 Sec. 21, about 0.7 airmi (1.1 km) NE of crossing of St. Rte. 29 over Cypress Creek, 4 ♂II, 5 ♀, 18 Mar 1986, R.L.J. and K.L.G., colls.; (7) T2N, R10W, NW/4 SW/4 SW/4 Sec. 4, 1 ♂II, 1 ♀, 1 ♂

imm., 1 ♀ imm., 29 Mar 1985, R.L.J., coll.; (8) compartment 61, T2N, R10W, SE/4 SE/4 SW/4 Sec. 8, small bog area just S of active oil well, about 4.1 airmi (6.6 km) SSE of jct. U.S. Hwy. 98 and St. Rte. 29 in New Augusta, 6 ♂II, 6 ♀, 1 ♂ imm., 2 ♀ imm., 18 Mar 1986, R.L.J. and K.L.G., colls.

Life history and environmental notes.—First form males were taken on 18 and 29 March and 29 October; the ovigerous female was captured on 9 November, at which time she was carrying about 36 fertile eggs and was discovered within the chimney, above the water table. All were taken from saturated sandy soil associated with pitcher plant savannahs. Collections 1–3, above, were dug from the complex burrows, but the subsequent ones were collected using a modification of a trap designed by Norrocky (1984) for use in Ohio. These traps have yielded remarkable results for the Mississippi Museum personnel in their studies of south Mississippi habitats. The greatly increased number of specimens per unit effort afforded by this technique has permitted them to accumulate an excellent collection of burrowing crawfishes from the Jackson Prairie, which is, except for Hobbs' efforts in Georgia and South Carolina, spread over many more years, possibly the most thorough representation of such animals from a particular region available anywhere.

I have not collected the animals myself, so I have no details of associated plants or color notes. In one formalin-preserved specimen, however, a lavender ground color, not unlike *F.* (*C.*) *byersi,* was evident when I first examined the specimen. I also was able to examine methanol-preserved specimens from localities 5, 6, and 8, above, within one month of their collection. In all a distinct lavender color, similar to that seen in *byersi,* was evident on the hand or dactyl or both. In two of the first form males, the rostral margins and postorbital ridges were deep purple.

Relationships.—*Fallicambarus* (*Creaserinus*) *gordoni* is most closely related to *F.* (*C.*) *danielae* but it is easily distinguished by a broader rostrum and the presence of two, rather than one, prominent tubercles in the excision on the opposable margin of the dactyl. In first form males the mesial process extends scarcely beyond the tip of the central projection, and the notch at the apex of the latter, if present, is never so obvious as in *danielae.* In females, the sinus begins in the far caudal half of the annulus, beneath an overhanging elevation of the caudal margin. In *F.* (*C.*) *danielae* the tip of the mesial process extends well beyond the apex of the central projection, which projection is also clearly notched subapically; the annulus of the female has no overhanging, conspicuously elevated caudal margin, and the sinus originates near the middle of the annulus. The central projection and mesial process of *F.* (*C.*) *danielae* are directed so that their apices are more or less 90° to the principal axis of the basal part of the pleopod; in *F.* (*C.*) *gordoni* the central projection apex is directed at least 150° and the mesial process as much as 145°. See also the comments under the "Relationships" section for *F.* (*C.*) *burrisi,* above.

Acknowledgments

I am indebted to all those people identified in the lists of collectors, and especially to John W. Burris and Kenneth L. Gordon, successive coordinators of the Mississippi Natural Heritage Program, who made diligent searches for these beasts; equally tireless in such efforts were Robert L. Jones, of the Program, and Paul D. Hartfield of the Mississippi Museum of Natural Science. Horton H. Hobbs, Jr., was his usual generous self in offering many helpful suggestions during this work. My friend and colleague, Michel G. Lelong, helped with the identification of plant associates.

Literature Cited

Faxon, Walter. 1884. Descriptions of new species of *Cambarus* to which is added a synonymical list

of the known species of *Cambarus* and *Astacus*.—Proceedings of the American Academy of Arts and Sciences 20:107–158.

Hobbs, Horton H., Jr. 1941. Three new Florida crayfishes of the subgenus *Cambarus* (Decapoda, Astacidae).—American Midland Naturalist 26: 110–121.

———. 1975. New crayfishes (Decapoda: Cambaridae) from the southern United States and Mexico.—Smithsonian Contributions to Zoology 201:iii + 34 pp.

Norrocky, M. James. 1984. Burrowing crayfish trap.—Ohio Journal of Science 84:65–66.

Penn, George Henry, Jr. 1953. A new burrowing crawfish of the genus *Procambarus* from Louisiana and Mississippi (Decapoda, Astacidae).—Tulane Studies in Zoology 1:71–76.

———, and Guy Marlow. 1959. The genus *Cambarus* in Louisiana.—American Midland Naturalist 61:191–203.

Department of Biological Sciences, University of South Alabama, Mobile, Alabama 36688.